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State of California
Department of Public Works
Division of Highways
Materials and Research Department

April 1965

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Your File: W.O. AJ00 131C-37
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Mr. Carl C. McElvy
State Architect
Department of General Services
Office of Architecture and Construction
Sacramento, California

Attention: Mr. Preston Roche
Supervising Mechanical Engineer

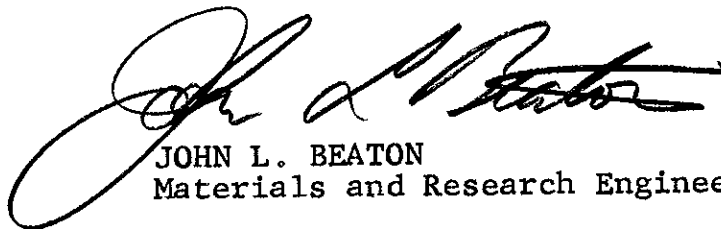
Dear Sir:

Submitted in response to your memorandum of January 21,
1965, is a report concerning:

VIBRATION STUDY IN RETIREMENT BUILDING

Study made by	Structural Materials Section
Under general direction of	E. F. Nordlin
Unit supervisor	J. E. Barton
Tests and report by	Louis Bourget

Very truly yours,


JOHN L. BEATON
Materials and Research Engineer

LB:mw
cc: O. E. Anderson
Vern Thornburg

INTRODUCTION AND SUMMARY

As requested by a Memorandum dated January 21, 1965, from the Department of General Services, Office of Architecture and Construction, a study has been made of the vibration problem in the Forestry Drafting Room 1550-55 (West) in the Retirement Building. The vibration complaints concerned Equipment Room 15 West as the suspected source of the trouble.

The specific complaint was of conduction borne vibration getting into the drafting tables and interfering with the precision map work being done in this area.

Throughout the pursuit of the cause of this vibration, we were greatly helped by the assistance of Mr. Vern W. Thornburg of the Office of Architecture and Construction.

The principal trouble leading to conduction of steady state vibration was caused by off-center safety bolts forming a mechanical bridge across two of the isolators on the east side of the inertia base for the tandem fan. These faults were corrected, and the isolators are now performing in a normal manner.

A unique method of vibration detection was forced upon the investigators due to limitations of available electronic devices. This method is described in this report.

Other transient sources of vibration beyond mechanical control are identified along with a possible palliative, in case future experience justifies the need.

DISCUSSION

The search for the elusive cause was, at first, very frustrating as the maximum vibration component was apparently below the range of the measuring equipment available.

The first instrument employed was a Consolidated Electro-dynamics Corporation Vibration Meter 1-117. This has a cutoff around 50 cycles per second on the most sensitive range (which was required to obtain any readings at all in the complaint area).

Next, a General Radio Type 1560-P11 vibration pickup system attached to a sound level meter was tried. This device is capable of measurement down to 20 cycles per second, but long term measurements gave evidence of beat frequencies below the range of this equipment.

Remembering an artifice discovered while searching for the cause of a similar baffling vibration that disturbed microscopes in the micro-biology laboratory at Los Angeles State College some years ago, we partly filled a six inch sauce dish with water and observed the magnitude of optical shimmers of the reflected image lines from diffuser panels mounted on the ceiling light fixtures. This yielded excellent results in the sub-sonic region, though non-numerical in character. Anyone walking past the nearest partitions around this area would generate as much vibration as obtained from the unknown source. This human source of transient vibration was reasonably infrequent, and apparently not so annoying as the steady state type from motor driven equipment. At least we now had a means to detect any improvement in the situation.

Careful reexamination of the fan inertia base finally divulged that freedom of deflection across the isolators was unequal. One corner would yield reasonably well to additional vertical force while another corner was much stiffer and less yielding. Vern Thornburg requested that the Area Construction Office make an inspection of the spring isolators to determine the cause of the condition. This was done by Mr. George D. Andes, District Mechanical Inspector. Mr. Andes found that the safety bolts through two of the spring isolators were sufficiently off center so as to mechanically short out the system. Both of these bolts were on the east side of the fan inertia base. Mr. Andes hammered these bolts into a proper clearance position.

Subsequent optical tests made on the drafting tables in the complaint area showed a reduction of steady state

vibration to a fraction of the former levels. One table was completely free of any detectable steady state vibration. A condition has now been achieved whereby a single person walking across the room will generate over ten times more interference than can be detected from the fan. The vibration isolators are now functioning normally.

It should be noted also that an airplane in the vicinity can develop levels of vibration in the building structure at the 15th floor level that may bother this activity and yet not disturb other people who are performing less critical tasks. The only feasible method to accomplish further improvement is to move this activity to the lowest floor level in the building. Checks made in the library on the first floor indicate a lower quantity of disturbance from airplanes, mechanical equipment or people walking in the vicinity. We believe that the people in the complaint area can probably cope with the remaining conditions of vibration that arise from sources beyond control. If further complaint persists, the agency concerned should be advised of the necessity of moving to a lower floor level as the only remaining palliative. This would probably require a mutual agreement with some other agency to trade office space.